IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

KEITH GARY BOYER, ET AL.

Group Art Unit: 2133

Examiner: Chaudry, Mutaba M.

Serial No.: 09/843,269

Filed: April 26, 2001

For: DYNAMIC ERROR CORRECTION CODE SHORTENING

Attorney Docket No.: 00-111-TAP / STK 00111 PUS

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Mail Stop Appeal Brief - Patents
Commissioner for Patents
U.S. Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an Appeal Brief from the final rejection of claims 1-12 of the Office Action mailed on October 19, 2004 for the above-identified patent application.

I. REAL PARTY IN INTEREST

The real party in interest is Storage Technology Corporation ("Assignee"), a corporation organized and existing under the laws of the state of Delaware, and having a place of business at One StorageTek Drive, MS-4309, Louisville, Colorado 80028-4309, as set forth in the assignment recorded in the U.S. Patent and Trademark Office on April 26, 2001 at Reel 011772 /Frame 0492.

CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8

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May 6, 2005	Timothy J. Marsh	Timothy J. Marsh
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II. RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences known to the Appellant, the Appellant's legal representative, or the Assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-12 are pending in this application. Claims 1-12 have been rejected and are the subject of this appeal.

IV. STATUS OF AMENDMENTS

An amendment after final rejection was filed on January 14, 2005 and has been accepted for entry.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The invention relates to a method of dynamically shortening error correction codewords in an error correction code interleaving arrangement that divides error correction codewords into segments for recording across a matrix. The method comprises defining a matrix wherein the matrix comprises user data and error correction codewords (204), receiving user data for recording on a storage medium (200), determining the size of the received user data and the amount of the matrix that will be filled by the received user data (200), and recording error correction codewords segments in an interleave dynamically created to correspond only to the portion of the matrix filled by the user data (204, 206). (See Figure 4 and the Specification at page 6, line 23 - page 7, line 2.)

Another embodiment of the invention relates to a system (100) for dynamically shortening error correction codewords used in an error correction code interleaving. The system (100) comprises a data buffer (102) for receiving user data. The data buffer (102) comprises a processing arrangement for determining the amount of data received in the data

buffer (102). The system (100) further comprises an error correction code write buffer (108) connected to the data buffer (102) for receiving the user data (104) as well as an indication of the amount of data (106). The write buffer (108) comprises a processing arrangement for dynamically determining a shortening value for error correction codewords that correspond to the amount of user data (104), and for recording the user data (104) and error correction codeword segments dynamically in an interleave. The interleave is created to correspond only to the portion of the matrix filled by the user data (104) on a recording medium (110). (See Figure 2 and the Specification at page 5, lines 1-13.)

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,349,400 B1 issued to Senshu ("Senshu '400").

VII. ARGUMENTS

A. The Rejection Of Claims 1-12 Under 35 U.S.C. § 103(a) Should Be Reversed Because It Is Based On An Improper Change To The Principle Of Operation Of The Senshu '400 Reference

As set forth in independent claims 1 and 7, the Applicants' invention is directed to a method and system for dynamically shortening error correction codewords ("ECC"). As recited in claim 1, for example, the invention comprises "receiving user data for recording on a storage medium," "determining the size of the received user data and the amount of the matrix that will be filled by the received user data," and "recording error correction codewords segments in an interleave dynamically created to correspond only to the portion of the matrix filled by the user data."

In such a fashion, the Applicants' claimed invention generally improves overall efficiency, including processing time, by determining in advance that the number of bytes of user data will only fill a portion of a matrix, and automatically shortening the number of ECC word segments to match the actual user data fill. (Specification, page 2, lines 23-28.)

In contrast to the Applicants' claimed invention, Senshu '400 discloses making the input/output order of user data in an error correction codeword block coincident with the direction of processing of the error correction codes. (Senshu '400, Abstract.) Thus, coding can be started at the time when necessary data for generating one code is transmitted, without waiting for transmission of data for one ECC block. (Id.) Similarly, transmission of user data can be started at the time when correction of one code is completed, without waiting for completion of correction operation for one ECC block.

(Id.) Figure 5 of Senshu '400, reproduced below, compares an ECC block in which the direction of user data is different from the direction of correction codes, and an ECC block in which the direction of user data is the same as the direction of correction codes. (Id. at col. 7, line 66 - col. 8, line 3.)

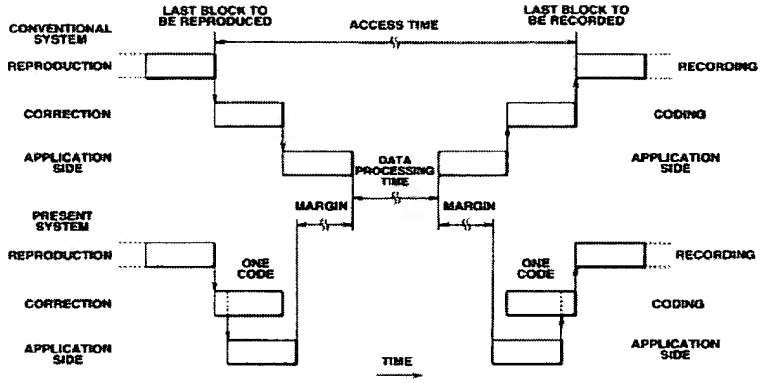

FIG.5

In the final Office Action, the Examiner admits that Senshu '400 does not explicitly teach determining the size of the user data and the amount of matrix that will be filled by the received user data. (Final Office Action, page 5, lines 5-6.) However, the Examiner asserts that it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a determining means to determine the size of the user data before recording within the data recording method and apparatus of Senshu '400. (Id. at page 5, lines 9-12.)

The Examiner proposes a modification to Senshu '400 that improperly changes its principle of operation. As noted in § 2143.01 of the *Manual of Patent*

Examining Procedure, "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)."

As previously demonstrated, the principle of operation of Senshu '400 is coding at the time when necessary data for generating one code is transmitted, without waiting for transmission of data for one ECC block. Modifying Senshu '400 as suggested by the Examiner to determine the size of the user data before recording would impermissibly change that principle of operation. Accordingly, the Examiner has failed to establish a *prima facie* case for obviousness and the Applicants respectfully request that the rejection of independent claims 1 and 7 be reversed.

Claims 2-6 and 8-12 depend from independent claims 1 and 7. Therefore, Applicants respectfully request that the rejection of these claims be reversed for the reasons previously discussed.

B. The Rejection Of Claims 1-12 Under 35 U.S.C. § 103(a) Should Be Reversed Because The Only Reference Relied Upon, Senshu '400, Fails To Teach Or Suggest All Of The Claimed Limitations

Claim 1 of the present invention includes the step of "recording error correction codewords segments in an interleave dynamically created to correspond only to the portion of the matrix filled by the user data." Similarly, claim 7 of the present

invention recites a "write buffer including a processing arrangement for dynamically determining a shortening value for error correction codewords that correspond to the amount of user data, and recording the user data and error correction codeword segments dynamically in an interleave created to correspond only to the portion of the matrix filled by the user data on a recording medium."

As noted in § 2143.03 of the *Manual of Patent Examining Procedure*, "[t]o establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." Senshu '400, however, fails to teach or suggest all limitations of the present invention.

Specifically, Senshu '400 does not teach or suggest a dynamically created interleave. Instead, Senshu '400 provides that data recording/reproduction may be carried out in a disc format such that the ECC block is constituted by one or more sectors, the sector is constituted by a plurality of frames, and the block length of the ECC block is expressed by the equation: block length = number of sectors x number of frames x frame length. (Senshu '400, col. 15, lines 35-41, col. 23, lines 21-30.)

Accordingly, the length of the ECC block taught by Senshu '400 is not dynamically created to correspond to the amount of user data but, instead, is determined by the sector and frame configuration of the disc format. Therefore, Senshu '400 fails to teach or suggest all the limitations of the present invention, and the Applicants respectfully request that the rejection of independent claims 1 and 7 be reversed.

Claims 2-6 and 8-12 depend from independent claims 1 and 7. Therefore, Applicants respectfully request that the rejection of these claims be reversed for the reasons previously discussed.

C. Claims 5-6 and 11 Are Separately Patentable And The Rejection Of Those Claims Under 35 U.S.C. § 103(a) Should Be Reversed Because The Only Reference Relied Upon, Senshu '400, Fails To Teach Or Suggest All Of The Claimed Limitations

A *prima facie* case of obviousness also has not been established for claims 5-6, and 11. Claims 5-6, and 11 recite limitations directed to a method and system, respectively, for reading data from a storage medium. In the final Office Action the Examiner admits that "Senshu only teaches the writing aspect of data to a recording medium...." (Final Office Action, page 6, lines 14-16.) Therefore, the prior art fails to teach or suggest the reading limitations of claims 5, 6, and 11. *See* M.P.E.P. § 2143.03 (citing *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)). The Applicants, therefore, respectfully request that the rejection of claims 5, 6, and 11 be reversed.

CONCLUSION

For the reasons set forth above, the Examiner has failed to establish a *prima facie* case for the rejection of claims 1-12. Therefore, the final rejection of these claims should be reversed.

The Commissioner is hereby authorized to credit overpayments or charge fees, including the fee of $500 under the provisions of 37 C.F.R. § 41.20(b)(2), in connection with this filing to Storage Technology Corporation Deposit Account No. 19-4545. A duplicate of this page is enclosed for this purpose.

Respectfully submitted,

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Enclosure - Appendices

VIII. CLAIMS APPENDIX

1. A method of dynamically shortening error correction codewords in an error correction code interleaving arrangement that divides error correction codewords into segments for recording across a matrix, the method comprising:

defining a matrix wherein the matrix comprises user data and error correction codewords;

receiving user data for recording on a storage medium;

determining the size of the received user data and the amount of the matrix that will be filled by the received user data; and

recording error correction codewords segments in an interleave dynamically created to correspond only to the portion of the matrix filled by the user data.

2. The method of claim 1 wherein the user data is partitioned for recording onto the recording medium in a plurality of tracks, and each error correction codeword segment is recorded on a separate track.

3. The method of claim 1 wherein the matrix includes a predetermined number of partitions each dimensioned to hold a predetermined number of bytes of user data.

4. The method of claim 3 wherein if the user data does not fill all the partitions, shortening the error correction codewords to provide an interleave of the error correction codeword segments corresponding to the number of partitions filed by the user data.

5. The method of claim 1 further comprising:

reading the data from the storage medium;

determining when the data only fills a portion of the matrix; and

automatically recreating the error correction codewords as a function of the dynamically created interleave recorded on the medium.

6. The method of claim 5 wherein reading the data from the storage medium comprises determining the shortening value of error codewords corresponding the partial data fill.

7. A system for dynamically shortening error correction codewords used in an error correction code interleaving comprising:

a data buffer for receiving user data, the data buffer including a processing arrangement for determining the amount of data received in the data buffer;

an error correction code write buffer connected to the data buffer for receiving the user data as well as an indication of the amount of data, the write buffer including a processing arrangement for dynamically determining a shortening value for error correction codewords that correspond to the amount of user data, and recording the user data and error correction codeword segments dynamically in an interleave created to correspond only to the portion of the matrix filled by the user data on a recording medium.

8. The system of claim 7 wherein the write buffer processing arrangement is further arranged to divide each of the determined number of error correction codewords into a plurality of segments, and each segment is recorded on a different track.

9. The system of claim 7 wherein the write buffer processing arrangement is further arranged to process the user data into a predetermined number of partitions each dimensioned to hold a predetermined number of bytes of user data, and only partitions corresponding to the amount of user data are filled.

10. The system of claim 7 wherein the write buffer processing arrangement is further arranged to determine an amount of an error correction codeword matrix that will be filled by the received user data, the shortening size of the error correction codewords is determined to correspond only to the portion of the matrix filled by the user data.

11. The system of claim 7 further comprising:

an error correction read buffer having a processing arrangement for reading the data from the storage medium, and determining that the data only fills a portion of an error correction codeword matrix, wherein the read buffer processing arrangement automatically determines the shortening value of the error correction codewords corresponding the partial data fill.

12. The method of claim 1 wherein determining the amount of matrix that will be filled by the received user data comprises determining the number of partitions filled by the user data.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.